XIV. ON SOME AQUATIC OLIGOCHAETA IN THE COLLECTION OF THE INDIAN MUSEUM.

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During the past year I have, through the kindness of the authorities of the Indian Museum, received at various times specimens of small aquatic Oligochaeta for examination. An account of these is given in the present communication.

Our knowledge of the Oligochaeta fauna of the Indian region has of late years been very considerably increased through the researches of Michaelsen (*Mem. Ind. Mus.*, vol. i, No. 3, and *Abh. aus dem Gebiete der Naturwissenschaften*, Naturw. Verein, Hamburg, xix Band. 5 Heft) on the collections made by the Indian Museum. This increase in our knowledge however relates more especially to the terrestrial forms, and the number of aquatic Oligochaeta known from the Indian region is still very small. Especially is this the case with the large families of the Enchytraeidae and Tubificidae, so common in Europe; only one Tubificid, and one Enchytraeid, of which latter the genus is doubtful, having so far been recorded.

This may perhaps receive a partial explanation in the small size of these worms, and the fact that they consequently elude the collector, unless he happens to be specially interested in them or specially looking for them. Still, seeing that the Naididae, comprising the smallest or almost the smallest forms in the whole Order, are represented in the Indian fauna by about twenty species, it may not improbably be the case that Enchytraeids and Tubificids are actually somewhat rare.

Another hindrance to our knowledge of these small and delicate forms is the difficulty of adequately describing them—or even, it may be, of identifying them—from preserved specimens only. Most of those I have received from Calcutta have been preserved, since it is difficult to transport the living worms safely for 1,300 miles in this climate; of the species mentioned below, examples of *Aulophorus tonkinensis* however reached me alive. I am therefore conscious that the notes are not so full as is desirable, but considering the small amount that is known, it seems better to give the following descriptions, though incomplete in many ways, rather than to allow the material to be wasted.

Aeolosoma bengalense, sp. nov.

Found in the Museum tank, Calcutta, Nov. 10th 1910, C. Paiva. Mr. Gravely's accompanying note stated that the oil-globules were of the colour of blue-green algae, the stomach deep orange.

In the preserved condition the specimens were white in colour, 1—1½ mm. long, and ·2—·3 mm. broad. The prostomium was semicircular in shape, and no broader than the succeeding segments; conspicuous cilia clothe its ventral surface.

The largest number of segments noted in an animal which did not show any signs of approaching fission was fourteen. Other specimens of fourteen segments showed the beginning of an approaching division after the eleventh, or perhaps after the tenth segment; specimens with larger numbers of segments also showed a line of division after the eleventh segment. I cannot state what number of segments, if any, are intercalated at this point before division takes place, since in none of the specimens examined were there any newly forming groups of setae in this region.

The setae are all of the capillary type; dorsal and ventral series both begin in the same segment (ii). The setae are quite straight, long and thin, tapering gradually to a very fine point. In each bundle there is as a rule one, or sometimes two, long setae together with a few shorter ones; this difference in length is a real difference of type, since no setae of intermediate lengths occur; all the shorter setae are of approximately the same length, while the long seta of the bundle is very considerably longer, and it may be added considerably thicker also. This may be illustrated by the following figures, which give the lengths of the setae in μ in nine bundles; the figures in heavy type represent the lengths of the long, the other figures those of the short setae. (1) **234**, 122, 112, 112, 108. (2) **187**, 122, 122, 112. (3) **234**, 112, 103. (4) **244**, 141, 108. (5) **206**, 122, 122, 112, 94. (6) **178**, 112, 112. (7) **169**, 141, 103, 94. (8) **234**, 103, 103. (9) **225**, 103.

The average length of the long setae is thus nearly twice that of the short ones; and since the above measurements are taken from the bottom of the setal sac, the disparity in length between those portions which project beyond the body-wall is still greater.

Bundles of setae were sometimes seen without any long setae; usually there was one, occasionally two; it is possible that in those cases where none was seen, one may have dropped out. The shorter setae were usually two, three or four per bundle.

The buccal cavity is large, in the shape of a narrow bell, placed vertically in segment i; it is lined by a tall epithelium. The oesophagus, beginning at the dorsal end of the buccal cavity, occupies segments ii and iii, and is somewhat sinuous. The stomach extends from iv to viii, and is the widest part of the alimentary tube; the intestine begins in ix and extends to the posterior end.

The dorsal vessel is very distinct in stained preparations, extending along the whole length of intestine and stomach; it dilates on the dorsal surface of the oesophagus to form a 'heart,' coextensive with the oesophagus and in diameter equal to it; the dorsal vessel can again be followed forwards from the anterior end of the heart, over the buccal cavity, to which it is attached as far as the anterior border of the mouth.

The cerebral ganglion is conspicuous, fused with the epithelium of the dorsal surface of the prostomium. Thin strands cross the cavity of the prostomium vertically, each with a nucleus in the middle of its course; strands attach the lower surface of the cerebral ganglion to the epithelium of the ventral surface where the latter turns inwards to become continuous with the lining of the buccal cavity.

The only species of *Aeolosoma* in which the oil-globules are all of a green or blue-green colour are *A. headleyi*, Bedd., and *A. viride*, Stephenson. From the former the present species is distinguished by the setae being quite straight, and divisible into two kinds, long and short; from the latter by the deep orange colour of the stomach, the division of the setae into long and short, and apparently in the details of asexual multiplication (here $n = 11$, in *A. viride* $n = 8$). I therefore propose the following diagnosis:—

Length (preserved) 1—1·5 mm., breadth ·2—·3 mm. Segments up to 16 (or? more); n = 11. Setae all capillary; bundles consist as a rule of one long and several shorter, the long (210 μ) averaging twice the length of the shorter (110 μ). Oil drops blue-green. Oesophagus ii—iii, sinuous; stomach iv—viii, deep orange. Prostomium not broader than succeeding segments.

Chaetogaster spongillae, Annand.

1906. *Chaetogaster spongillae*, Annandale, *Journ. As. Soc. Bengal* (N.S.), vol. ii, No. 5.

Through the kindness of Dr. Annandale I received a few specimens of the above species, discovered and described by him a few years ago. The original account, however, deals largely with the bionomics of the animal; and a few additional notes on its anatomy may therefore not be superfluous.

The specimens which I received were all preparing to divide, and it will be convenient to distinguish the anterior portion, in front of the line of future fission, as A, the posterior, behind it, as B. The whole animal, A+B, measured about ·6 mm.; in one case A measured ·41, B ·18 mm.; in another A was ·39, B ·22 mm.; in each case the pharyngeal region (as far as the beginning of the oesophagus) was ·12 mm. Even allowing for contraction therefore, this appears to be the smallest species of

Chaetogaster known (Annandale gives the length of an individual which is not budding as about 1 mm.).

The margin of the mouth does not reach quite to the anterior tip of the body; there is hence a small prostomium. The mouth is large, and leads directly into the pharynx, as in other species.

The setae (fig. 1) are slender, with a slight ∫-shaped curve, double-pronged; the distal prong is half as long again as the proximal, but only two-thirds as thick at its base; the nodulus is proximal to the middle of the shaft, the proportions being:—proximal to nodulus: distal to nodulus:: 2: 3. There is no difference in type between the setae of the most anterior bundles and those situated more posteriorly, but there is a considerable difference in length; those of segment ii average about ·09 mm., those of the other segments about ·06, or two-thirds the former. There are on the average four setae per bundle.

In the specimens which I received, A possessed eight fully formed segments, and B three or four; between the two was a budding zone, in which young setal bundles—the anterior destined to belong to the posterior end of A, the posterior to the anterior end of B after separation—were occasionally seen.

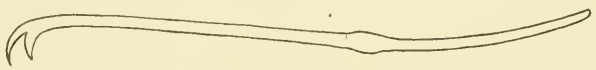

Fig. 1.—*Chaetogaster spongillae*: seta belonging to segment ii; × 890.

The animals therefore begin to divide when they possess eleven or twelve segments: the budding zone forms posterior to viii ($n = 8$), and in the budding zone presumably eight or nine new segments are formed,—three or four to complete A, and five to form the anterior end of B (of these five only the second bears setae); the ninth segment of the original undivided animal ultimately becomes the sixth of B.

Annandale mentions "longitudinal rows of minute, irregular tubercles on the 'head'." I have described similar elevations in *C. orientalis* (= *C. pellucidus*; *Rec. Ind. Mus.*, vol. i, part 3, and *cf.* pl. ix, fig. 1). I have however more recently convinced myself that these appearances are due merely to the muscular fibres which pass between the pharynx and the body-wall, and represent in fact the outer ends of these fibres; the same may not improbably be the case in *C. spongillae*.

The pharynx is a simple wide tube; it is followed by a very short oesophagus, to which succeeds the dilated part of the alimentary tract that I have previously (*loc. cit.*) called the crop; a slight constriction separates this from another dilatation, the stomach, which is followed by the intestine. Of these sections of the tract, the pharynx occupies segments i—iii, as far as the first dissepiment ($\frac{3}{4}$, *v. inf.*): the oesophagus is restricted

to iv, its posterior limit coinciding with the second dissepiment ($\frac{1}{3}$); the crop occupies v—vi, the stomach vii—viii, but since septa are not to be made out behind the oesophagus, these limits are approximate only, and have been fixed by reference to the setal bundles

In longitudinal sections the pharynx is seen to be lined by a thin layer of cuticle; its epithelium, like that of the oesophagus, is approximately cubical. The cells lining the 'crop' however are very much larger, of irregular shape and varying height: so that the epithelium of this portion of the tract has an uneven outline, reminding the observer somewhat of the inner layer of *Hydra*, and suggesting the possibility of intracellular digestion. Chloragogen cells are scanty or absent on the crop, abundant on the stomach.

The circulatory system could not be made out.

Annandale has noted the presence of an otocyst in the brain in this species,—a relatively large, globular, transparent cyst. I have not found any trace of such a cyst in the preserved specimens which I have examined, either mounted whole, or in longitudinal sections: the brain is large, and consists of two parts, an outer cellular surrounding a spherical granular looking mass. There are however a number of enigmatical appearances in connection with the brain of various species of *Chaetogaster*; thus, besides that which led in the present case to the suspicion of an otocyst, there is the structure described by Vejdovsky (*System und Morphologie der Oligochaeten*, p. 38) in *C. diastrophus* ("in dem Einschnitte zwischen den Gehirnlappen befindet sich eine glänzende, scharf contourirte braune Chitinplatte") and figured in his pl. vi, fig. 12; there is the densely pigmented body, possibly functioning as an eye, described by Annandale (*Journ. As. Soc. Bengal* (N. S.), vol. ii, No. 5, p. 189) in a species not named, as well as the sense-organ in the brain of *C. bengalensis* (Annandale, *ibid.*, vol. i, No. 4, p. 117); there is the bright, refractile body, in the same situation as the brown chitinous plate of *C. diastrophus*, described by me in *C. punjabensis* (*Rec. Ind. Mus.*, vol. i, pt. 2; and *cf.* pl. v, fig. 7); and the opaque granular mass, again in a similar situation, in *C. orientalis* (= *C. pellucidus*, *Rec. Ind. Mus.*, vol. i, pt. 3; and *cf.* text-figs. 4, 5).

The anterior part of the ventral nerve cord is, in a number of species of the genus, covered by nerve cells which have no segmental arrangement. In the present species the cord is interesting as showing a fairly distinct aggregation of the nerve cells into separate ganglia. There are no intervals, in the anterior part, where the cord is bare of cells; the cells invest the whole length of the cord as far back as the second setal bundle (segment vi), so that their aggregation into ganglia, though distinctly indicated, is still incomplete. There are two such aggregations in the pharyngeal region, the first of the two being at the level of the first setal bundle (segment ii); and three behind the pharynx, the last of these being opposite the second setal bundle

(segment vi). The arrangement therefore corresponds to the accepted numbering of the segments in *Chaetogaster*, according to which the second setal bundle is assigned to the sixth segment. Behind this the ganglia have the usual discrete arrangement.

On the clitellum, *cf.* my remarks in *Rec. Ind. Mus.*, vol. i, pt. 3, pp. 249—51.

Nais pectinata, Stephenson, var. *inaequalis*, var. nov.

In *Rec. Ind. Mus.*, vol. v, part 4, I recorded a new species of *Nais*, the peculiarity of which consisted in the possession of ctenate needle-setae in the dorsal bundles. The same material from which this species was obtained was shortly afterwards returned to me, in order that I might pick out a number of specimens for separate preservation in the museum. During this re-examination I came across a single specimen of a *Nais* in which the dorsal needles, though ctenate, differed considerably from those found in the ordinary *N. pectinata*; as however in other respects the specimen closely resembled the latter, I describe it here as a variety.

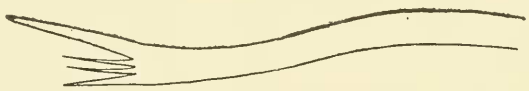

Fig. 2.—*Nais pectinata* var. *inaequalis*: a needle-seta belonging to a dorsal bundle; distal portion only.

Segments 50, plus an undifferentiated growing region at the posterior end. No *eyes*.

The *dorsal setal bundles*, beginning in segment vi, consist usually of one hair-seta and one needle; occasionally of one hair and two needles, or of two setae of each type: in the last case one of the hair-setae is much shorter than the other. The hair-setae are usually about 250 μ long, the shorter ones however about 100 μ; both are quite smooth. The needle-setae are 67—75 μ long, with a slight sickle-shaped curve which includes the distal third of the shaft; there is no nodulus The end is ctenate; but the tooth of the comb which lies towards the inside of the curve of the shaft is very much stronger, and considerably longer than the others (fig. 2); the outer tooth is also slightly larger than the intermediate ones. There may be two, three, or four small intermediate teeth; in one case there were none, the seta being thus merely bifid at its end.

The *ventral setae* begin in segment ii, and are in bundles of three or four; the length is 60—65 μ throughout the body. These bundles may be divided into two groups, an anterior, comprising those of segments ii—v, and a posterior, from segment vi onwards. In the anterior bundles the setae are slighter in form, and less strongly curved, the distal prong of the forked end

being $1\frac{1}{2}$ times as long, but only $\frac{2}{3}$ as thick as the proximal; the nodulus is slightly proximal to the middle of the shaft (proximal to nodulus : distal to nodulus :: 30 μ : 35 μ). In the posterior bundles the setae are stouter, the proximal part of the shaft is more strongly curved, the prongs of the forked end are equal in length, but the distal is only half as thick as the proximal; the nodulus is slightly distal to the middle of the shaft, the former proportions being reversed (proximal portion: distal portion :: 35 μ : 30 μ).

On comparison with the original description of *N. pectinata*, the present specimen is seen to differ not only in the shape of the ends of the dorsal needle-setae, but in the considerably greater number of body-segments, the position of the nodulus, and the relative sizes of the prongs of the ventral setae; slighter differences are seen in the lengths of the dorsal needles and of the ventral setae, and in the respective numbers of ventral setae per bundle in the two forms. It seems advisable therefore to separate this specimen as a distinct variety; the name *inaequalis* is meant to refer to the great disparity in size of the teeth of the comb formed by the end of the dorsal needles.

It may be mentioned in passing that I again found a specimen of *Pristina longiseta*, Ehrbg., during this examination of the material (*cf.* the former paper, referred to above).

Stylaria lacustris, L.

The present species is one of the best known and most easily recognized of all the Naididae: so far, however, the only record of its occurrence in the Indian region is from Lahore (*Mem. Ind. Mus.*, vol. i, No. 3, p. 276), where I obtained a single specimen.

I received the present specimens in January of this year from Mr. Gravely, who obtained them from a pond in the Zoological Gardens at Calcutta. The first consignment was sent alive; but when the tube was opened, after three days, only one specimen was alive, and that was merely a mutilated fragment of fourteen segments, without either anterior or posterior end of the body complete. It was however interesting as embracing at its anterior end a part of the genital region, including some of the clitellum and a portion of the ovisac. Some individuals would therefore seem to become sexual in Calcutta in January.

Mr. Gravely next sent me some preserved specimens; unfortunately none of these had the sexual organs developed, but all were dividing asexually. The *length* of the chains was about 8 mm.—longer, presumably, during extension in life. The triangular *prostomium* ended in a very long narrow proboscis, and eyes were present, as usual. The total number of *segments* varied; from 36 to 54 could be counted bearing setae, and behind this was a growing zone, in which distinct segments were not yet differentiated. The body was covered with a very distinct *cuticle*, much thicker, I think, than is usual in the Naididae and especially

obvious as a clear glassy layer over proboscis, prostomium, and anterior segments, where it was 5—6 μ in thickness.

The *dorsal setae*, beginning in segment vi, were usually two per bundle, both hair-setae, but of unequal length. The longer of the two was about 530 μ in length, or double the diameter of the body; the shorter was about half the length of the longer. In addition, contained within the setal sacs, and reaching only to the level of the surface of the body, there were one or two fine pointed hair-like setae, 50 μ long, probably of the nature of 'replacing setae.'[1]

The *ventral setae*, mostly six or seven in a bundle, but sometimes as many as nine, were in length about 130 μ. Of the two prongs at the outer end, the distal was very much longer and thicker than the proximal, so that on a superficial examination the setae sometimes appear to end in a single somewhat sharply curved hook; the nodulus was slightly proximal to the middle; and the proximal portion of the shaft was bent at a well-marked angle, instead of showing the usual even curve. These setae therefore resembled those of the specimen recorded from Lahore, as illustrated in *Mem. Ind. Mus.*, vol. i, No. 3, pl. xix, fig. 47.

The *alimentary tract* begins to be covered by chloragogen cells in segment vi. The stomach is a well-marked dilatation beginning in vii, either at the level of the setae, or close behind dissepiment $\frac{6}{7}$; it extends as far as the setae of viii; its wall is composed of large granular cells. The alimentary tube is again narrowed behind the stomach, dilating finally in x to become the intestine.

Body-cavity corpuscles were noted in the first (the mutilated living) specimen, as small clear homogeneous spindle-shaped bodies without visible nucleus; they were not visible in the preserved specimens.

The position of the first *nephridium* varied; in some specimens it was in vii, in about an equal number in viii, and once in ix. In cases where A (the first animal of the chain) had the first nephridium in viii, it was in viii in B also. Since B receives five segments from the budding zone (v. *post.*), segments vi and vii of B belonged originally to the middle part of the body of the parent or undivided animal, and hence presumably contained nephridia; the nephridia of these segments must therefore have degenerated, in these cases, at the onset of asexual division. My previous specimen from Lahore had the first nephridium in ix (*loc. cit.*).

The shape of the *cerebral ganglion* in the preserved specimens is shown in text-fig. 3; it is indented anteriorly and posteriorly, and is remarkable in possessing a pair of large antero-lateral lobes. It thus differs markedly from the Lahore specimen (*loc. cit.*, pl. xix, fig. 48).

[1] But see, on the subject of such supposed 'replacing setae', Piguet, *Rev. Suisse de Zool.*, T. 141, p. 290; and, in regard to another species, Michaelsen, *Mem. Ind. Mus*, vol. i, No. 3, p. 134.

The process of *asexual division* could be fairly well followed from the preserved specimens. The value of *n* varies: 15, 17, 18, 20 and 21 were noted; in the budding zone are produced five segments which will form the anterior end of B, and an indefinite number forming the posterior part of A; the proboscis of B points backwards. The peculiarity of the process in these specimens is the situation of the second and third budding zones: the second zone of budding is established one original segment in front of the first, *i.e.*, behind segment *n*—1; and the third appears again one segment in front of the second, behind segment *n*—2. The fourth appears in B, *e.g.*, it may be behind original segment xxxvi. (*Cf.* Piguet, "Observations sur les Naididées," *Rev. Suisse de Zool.*, T. 14, 1906, p. 289.)

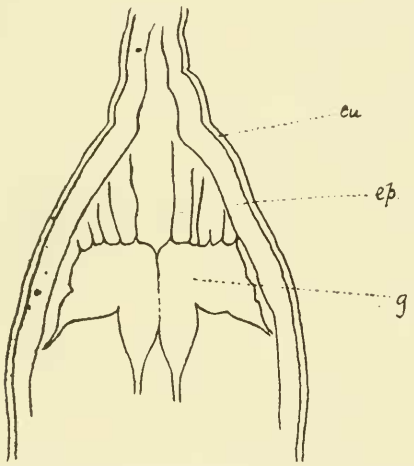

FIG. 3.—*Stylaria lacustris*: a small part of the anterior region of the body, including the base of the proboscis; to show the shape of the cerebral ganglion: × 210. *Cu.*, cuticle; *ep.*, epithelium; *g.*, ganglion.

Pristina proboscidea, Bedd., f. *typica*.

With the preserved specimens of *Stylaria lacustris*, just described, there occurred a single individual of the species discussed by Michaelsen, *Mem. Ind. Mus.*, vol. i, No. 3, p. 133, under the above designation. The specimens submitted to Michaelsen were found living in *Spongilla crassissima* and *S. carteri*, by Annandale in Calcutta; the individual which I examined was taken with the *Stylaria* from a pond in the Zoological Gardens and was therefore living freely at the time of its capture. The specimen agrees in most respects with what Michaelsen says; a short note will therefore be sufficient.

The specimen was considerably curled; its *length* was estimated at 5 mm. The '*proboscis*' was much shorter than in the case of the specimens of *Stylaria* amongst which it was found,

and was much less sharply marked off from the basal portion of the prostomium, of which it is an extension. There were no *eyes*. The *segments* numbered 36, plus an undifferentiated posterior region.

The *dorsal setae*, 2—5 per bundle, begin in segment ii; they are all hair-setae, and are not specially elongated in any particular segment. When, as often, they are 3 or 4 per bundle, all are of approximately equal length; in a bundle of 5 setae, three were longer than the rest (540 μ—between two and three times the diameter of the body), one was somewhat shorter (360 μ), and one much shorter still (less than 180 μ). These setae show the fine serrations noticed by previous observers; on the longer hairs the serrations are about 5 μ apart, or 6 μ towards the base; on a smaller hair they are rather closer—about 4 μ apart; they fade away altogether near the insertion of the setae into the body-wall; they are present on the setae of segments ii and iii as well as in all the other segments.

The *ventral setae* were 3 per bundle in segment ii, 4 and 5 on each side respectively in iii, 4 and 6 in iv, 6 in v: while in the middle part of the body 9 setae per bundle was not uncommon; the number per bundle increases therefore on passing from the anterior end towards the middle region of the body. The variations in the thickness of the shaft of the setae in the anterior segments were similar to those recorded by Michaelsen (*loc. cit.*); in segment ii the thickness was 3 μ, in iii 2·5 μ and in iv less than 2 μ.

Septal glands were present in segments iii, iv and v; the round *stomach* occupies viii; the alimentary canal narrows again behind the stomach, and dilates finally to become the *intestine* in x. The first *nephridium* was in ix.

As to the process of *asexual reproduction*, $n = 16$; of the segments produced in the zone of budding, the seven posterior ones are placed behind the plane where division will take place, and go to form the anterior end of B. The next zone of budding to be produced appears behind segment xv, *i.e.*, one original segment in front of the first: so that the animal which will ultimately be separated from this region contains only one of the original segments of the parent. The third zone of budding was being established after segment xxix of the original animal; thus, in B, $n = 29$ minus 16 (segments in front of the first zone of budding) plus 7 (segments added to form the head of B) = 20.

Aulophorus tonkinensis (Vejd.).

This interesting form, first described by Vejdovsky from a single incomplete specimen, has since been more thoroughly investigated by Michaelsen. The latter author's last reference to it (*Mem. Ind. Mus.*, vol. i, No. 3, p. 132, where the previous literature is given) records that it was collected by Annandale in several localities in India, and gives a note by Annandale on the habits of the living worm.

In December of last year (1910), I received, through the kindness of Dr. Annandale, a tube containing specimens of this worm, sent off alive from Calcutta. On their arrival in Lahore, about half the specimens were dead and disintegrating; a number were alive but motionless; and a few were still active, protruding themselves from their tubes. A subsequent consignment received in January of this year were unfortunately all dead.

Observations on the tubes, and on the mode of progression of the animal, confirmed Annandale's statements. The tubes were composed of bits of leaves, small fragments of wood, and black granular matter; they were always found floating on the surface. In the second batch of specimens the animals were all dead, as has been said, and the tubes were empty; here in all cases there was seen to be a thin and delicate transparent tube within the rough outer one; this was probably the case, though it was not observed, in the first batch also.

The mechanism of progression was much the same as noted by Annandale, modified by the fact that the tubes were floating on the surface. Thus, in a watch-glass, the animal protruded the anterior part of its body downwards and forwards till it touched the bottom, where it attached itself by means of its circular pharynx, using this latter as a sucker; it might then crawl slowly along, the tube still floating on the surface, without ever letting go its hold. Or it would contract its body, thus pulling the tube forward; then it would let go, and extending itself regain its hold on the substratum by means of its pharynx a little in advance of the former place.

The most distinctive characters of the species are to be found in the setae, gills and palps. These features have however been previously described: and I will therefore only add a few particulars concerning the internal anatomy, observed during the examination of the living worms.

The *pharynx* is large and wide, and extends backwards to dissepiment $\frac{3}{4}$; the *oesophagus*, which succeeds, reaches as far as $\frac{8}{9}$; chloragogen cells begin in segment vi; the *stomach* occupies ix; the alimentary tract narrows again in x, to dilate finally in xi, where it becomes the *intestine*.

Body-cavity corpuscles are present, as small circular or irregular homogeneous and refractile bodies.

The *blood* is a very pale red. The *dorsal vessel* is dorsal only in name throughout most of its length, as in related forms; it appears as a clear streak in the chloragogen covering of the intestine and stomach, being thus embedded in the alimentary wall; in segment ix it becomes lateral in position, having thus far been ventral; in viii it separates itself as a distinct vessel with walls of its own; and shortly after this takes up a dorsal position above the oesophagus. The *ventral vessel* is distinct from the alimentary canal throughout the body. *Contractile loops* are present in the hinder part of segments vii and viii respectively, lying on the septum.

The first *nephridium* occurs in segment vii.

In the asexual reproductive process, by fission, $n = 17$; of the segments produced in the budding zone, the posterior five (*i.e.*, four seta-bearing segments plus one without setae) go to form the anterior end of the posterior animal.